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THE WORK OF THE HUNTLEY RECLAMATION PROJECT EXPERIMENT FARM IN 1913.[1]

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INTRODUCTION.

The experiments carried on at the Huntley Experiment Farm are concerned chiefly with crops under irrigation, although a tract of about 20 acres of land lying above the irrigation canal is devoted to experiments with dry-land crops. This dry-land work is under the direction of the Office of Dry-Land Agriculture and includes crop rotation and tillage experiments. The experiments with crops under irrigation include crop rotation and tillage methods, variety tests of field crops, tests of cropping methods, pasture-grass tests, and tests of fruit trees, small fruits, and vegetables.

CONDITIONS ON THE PROJECT.

CLIMATIC CONDITIONS.

The rainfall at the Huntley Experiment Farm during the year 1913 amounted to 11.92 inches, which was about 2 inches less than the average for the past three years. The period free from frost was 136 days, as compared with 125 days in 1912 and 114 days in 1911. The climatological observations [2] made during the past three years are summarized in Table I.

[1] The Huntley Experiment Farm is located on the Huntley (Mont.) Reclamation Project, adjacent to the Osborn town site. It comprises about 200 acres of public land withheld from entry by the Department of the Interior at the time of the opening of the project, to be used as an experiment farm. Of the 200 acres, only about 80 acres are irrigable, some of the land being occupied by two railroads, the main irrigation canal, and a large waste ditch, and part of it lying above the canal. In addition to the land mentioned, a tract of 40 acres of the heavy land near the town of Worden is used for experiments in reclaiming alkaline soils. The work of the farm is under the supervision of the Office of Western Irrigation Agriculture. Other offices in the Bureau of Plant Industry and the Montana Agricultural Experiment Station are cooperating in the investigational work.

A report of the work of the Huntley Experiment Farm in 1912 was published in Bureau of Plant Industry Circular 121, issued April 12, 1913.

[2] These observations were made in cooperation with the Biophysical Laboratory of the Bureau of Plant Industry.

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TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm during the years 1911, 1912, and 1913.*

PRECIPITATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1911	0.64	0.32	.....	0.85	3.29	2.13	0.81	1.05	0.57	0.88	0.82	0.13	11.49
1912	.27	.21	0.41	2.00	2.44	1.14	2.25	1.39	2.97	3.25	.75	.....	17.08
1913	.29	.10	.40	.43	1.27	2.20	1.10	1.19	1.43	2.89	.45	.17	11.92
Average	.40	.21	.27	1.09	2.33	1.82	1.39	1.21	1.66	2.34	.67	.10	13.46

EVAPORATION (INCHES).

1911	.....	.....	.....	.....	4.388	5.827	7.124	8.875	6.071	5.079	2.568	.....	39.932
1912	.....	.....	.....	.....	.....	4.900	7.020	6.942	6.959	3.722	2.475	.....	32.018
1913	.....	.....	.....	.....	.....	4.300	5.980	7.020	6.300	4.450	.....	.....	28.050
Average	.....	.....	.....	.....	.....	5.009	6.708	7.612	6.443	4.417	2.521	.....	33.333

DAILY WIND VELOCITY (MILES PER HOUR).

Average:													
1911	.....	.....	.....	5.6	5.6	4.5	4.6	4.0	4.4	4.2	5.4	5.5	.....
1912	5.6	5.2	4.8	5.8	6.3	5.2	3.9	3.7	4.2	5.6	4.2	7.8	.....
1913	6.3	5.9	5.2	6.3	4.5	3.8	3.7	3.2	3.6	4.0	.....	.....	.....
Maximum:													
1911	.....	.....	.....	9.4	8.8	8.8	8.7	7.2	9.3	10.0	11.6	11.5	.....
1912	12.8	10.8	12.1	13.0	17.5	7.7	6.0	6.5	8.0	14.7	9.7	14.6	.....
1913	11.9	12.6	10.5	10.1	9.2	5.4	8.6	5.7	8.8	8.3	.....	.....	.....
Minimum:													
1911	.....	.....	.....	2.0	1.5	2.7	2.3	2.1	1.0	1.3	1.4	1.5	.....
1912	.7	1.6	.9	2.6	1.8	2.3	.6	.8	.9	1.5	1.0	2.7	.....
1913	1.0	1.7	1.9	1.0	.9	1.3	2.1	.8	.4	1.5	.....	.....	.....

MONTHLY TEMPERATURE (°F.).

Mean:													
1911	14.2	16.1	39.1	43.2	53.8	68.5	67.6	64.1	58.2	44.8	24.9	23.6	.....
1912	16.6	29.1	18.7	46.5	55.5	66.8	67.2	66.6	50.1	44.7	38.7	29.7	.....
1913	14.0	17.7	24.0	46.4	55.0	65.9	68.0	70.0	57.3	41.0	38.2	30.6	.....
Maximum:													
1911	50.0	40.0	74.0	77.0	92.0	94.0	97.0	97.5	94.0	84.5	55.0	55.0	.....
1912	53.0	52.0	62.0	78.0	90.0	99.5	95.0	93.0	89.0	79.0	69.0	59.0	.....
1913	56.0	63.0	61.0	82.0	89.0	88.0	98.0	97.0	94.0	81.0	67.0	55.0	.....
Minimum:													
1911	−26	−19	− 3	17.0	24.0	40.0	41.0	33.5	28.0	14.0	−20.5	−26	.....
1912	−35	− 5	−27	20.0	32.0	36.0	44.0	40.0	24.0	17.0	13	1	.....
1913	−32	−21	−25	20.0	31.0	42.0	43.0	44.0	29.0	20.0	14	− 5	.....

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		° *F.*		° *F.*	*Days.*
1911	May 26	32	Sept. 18	28	114
1912	May 13	28	Sept. 16	31	125
1913	May 5	31	Sept. 19	29	136

CROP CONDITIONS.

The season of 1913 was generally favorable to field crops. Field work was begun in early April and the soil at this time was in good condition for starting crops on account of the heavy rainfall of the previous winter. A drought later in the spring and early in the summer, however, made it necessary in a few cases on spring-plowed land to irrigate early to insure the germination of beets and other late-planted crops.

The first cutting of alfalfa was generally rather badly damaged by heavy rains that occurred during the latter part of June. The remainder of the season, however, was very favorable, and while some difficulty was experienced in harvesting the sugar-beet crop because of stormy weather, this work was completed in good season.

During the year 1913 there were 527 farms on the project, comprising an area of 23,577 acres of irrigable land. Of this, an area of 15,798 acres was in crops. Of the crops grown, alfalfa occupied 4,848 acres; sugar beets, 4,475 acres; and grains, chiefly oats and wheat, 5,772 acres. The total farm value of the crops grown in 1913 was $464,697, as compared with $350,771 in 1912. The average farm value per acre of crops was $29.35 in 1913, as compared with $27.50 in 1912. The acreage, yields, and farm value of the crops grown on the project in 1913 are stated in Table II, the figures being obtained from the United States Reclamation Service.

TABLE II.—*Acreage, yields, and farm values of crops produced on the Huntley Reclamation Project in 1913.*

Crop.	Area (acres).	Unit of yield.	Yields.			Farm values.			
			Total.	Average.	Maximum.	Per unit of yield.	Total.	Per acre.	
								Average.	Maximum.
Alfalfa	4,848	Ton	16,725	3.45	6.5	$5.50	$91,987.50	$18.97	$35.75
Barley	191	Bushel.	2,535	13.27	20.0	.48	1,216.80	6.37	9.60
Beans	39	do	306	7.85	40.0	3.00	918.00	23.55	120.00
Bluestem hay	292	Ton	543	1.86	2.0	12.00	6,516.00	22.32	24.00
Cucumbers	40	Pound.	600,000	15,000	20,000	.01	6,000.00	150.00	200.00
Corn	326	Bushel.	5,418	16.62	50.0	1.05	5,688.90	17.45	52.50
Flax	89	do	539	6.06	15.0	1.20	646.80	7.27	18.00
Millet	10	Ton	15	1.50	2.0	6.00	90.00	9.00	12.00
Oats	3,942	Bushel.	113,766	28.86	100.0	.32	36,405.12	9.24	32.00
Potatoes	99	do	11,889	120.10	450.0	.45	5,350.05	54.04	202.00
Sugar beets	4,475	Ton	45,511	10.17	25.0	6.00	273,066.00	61.02	150.00
Spelt	47	Bushel.	470	10.00	15.0	.60	282.00	6.00	9.00
Truck	218					100.00	21,800.00	100.00	100.00
Timothy	33	Ton	50	1.52	2.0	12.00	600.00	18.24	24.00
Wheat	1,177	Bushel.	21,410	18.19	60.0	.66	14,130.60	12.00	39.60
Less duplications	28								
Total	15,798						464,697.77		
Average								29.35	

EXPERIMENTS WITH IRRIGATED CROPS.

The experiments carried on with irrigated crops in 1913 were for the most part continuations of work conducted in 1912. These experiments included crop rotations, time and methods of planting alfalfa, time of harvesting alfalfa, tests of pasture grasses, variety tests of corn, irrigation of flax, fertilizer tests with wheat, oats, and barley, and tests of orchard trees and small fruits. The arrangement of the fields and the location of the experiments in 1913 are indicated in figure 1.

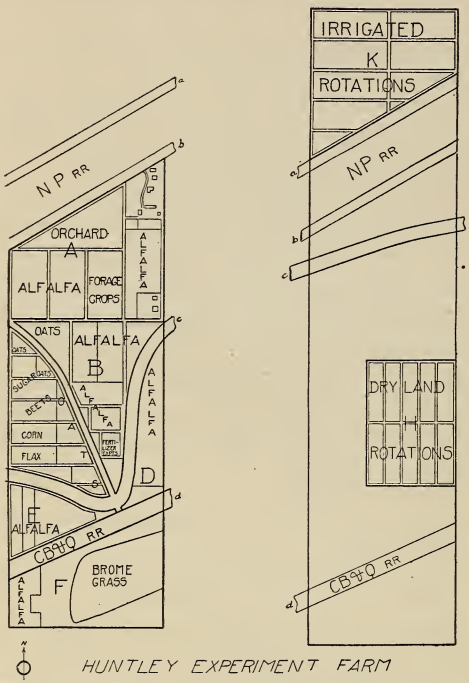

FIG. 1.—Diagram of the Huntley Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1913.

CROP ROTATIONS UNDER IRRIGATION.

In 1912 a series of crop rotations under irrigation was started on 70 quarter-acre plats in field K. In these experiments there are eleven 2-year rotations, three 3-year rotations, three 4-year rotations, and three 6-year rotations in which the following crops are grown in different sequences: Alfalfa, sugar beets, oats, potatoes, wheat, corn, and flax. While these experiments have not been under way long enough to obtain any conclusive results, there were some rather marked differences in 1913 in the yields of some of the crops. The average, maximum, and minimum yields obtained in 1913 are stated in Table III.

TABLE III.—*Average, maximum, and minimum yields obtained in the irrigated rotations at the Huntley Experiment Farm in 1913.*

Crop.	Variety.	Number of plats.	Yield per acre.			
			Unit.	Average.	Maximum.	Minimum.
Alfalfa, 1912	Montana	10	Ton	5.46	6.29	4.21
Alfalfa, 1913	do	6	do	2.20	2.51	1.79
Sugar beets	Kleinwanzlebener	14	do	13.08	16.80	9.25
Potatoes	Rural	13	Bushel	212.69	362.00	36.00
Oats	Swedish Select	15	do	84.16	126.80	37.80
Wheat	Pringle's Champion	3	do	27.25	36.12	17.44
Corn	Northwestern Dent	4	do	41.97	48.70	33.90
Flax	Minnesota No. 25	2	do	21.71	31.28	12.14

The highest yield of beets in 1913 was obtained from land which produced flax in 1912. The lowest yield was obtained where beets followed beets. High yields were secured from manured oat-stubble land. (See fig. 2.) Three plats of beets were grown after oats manured and five plats after oats not manured. The average yield of the three manured plats was 14.81 tons per acre, which was 2.04 tons higher than the average yield from unmanured oat land.

Potatoes yielded highest on manured oat land, the yield being 362 bushels per acre, which was 46 bushels higher than the yield obtained on oat land not manured.

Oats did best when planted on land which was in alfalfa in 1912, although one of the six plats on which oats followed potatoes yielded

FIG. 2.—Sugar beets on plat K–III–5. These beets were grown on manured oat-stubble land and yielded at the rate of 19.2 tons per acre, which was 3.4 tons above the average of all the beet plats in the rotations in 1913.

higher than any of the oats on alfalfa land. (See fig. 3.) The results obtained in 1913 indicate that oats can be expected to yield well when grown after either alfalfa, potatoes, or sugar beets. Comparatively low yields were obtained where oats followed corn, wheat, or oats.

The average yield of the four plats of corn was 41.95 bushels per acre. There were no very wide differences in the yields from the different plats. The highest yield was obtained where corn followed sugar beets and the lowest where corn followed oats.

The best yield of wheat was secured where wheat followed sugar beets, and the lowest yield was produced on land which was planted to oats in 1913.

Only two plats of flax are included in the rotations. On one of these, where flax followed flax, the yield was 12.14 bushels per acre.

On the other, where flax followed corn which was hogged off in 1912, the yield was 31.28 bushels per acre.

The chief results from the rotation experiments in 1913 are the following:

(1) Decidedly better yields were produced with crops grown in rotation than with the same crops grown continuously on the same land.

(2) The yields indicate that the practice of plowing under alfalfa and of applying barnyard manure greatly increases the productivity of the soil.

(3) The beneficial effect on the soil of growing cultivated crops, particularly sugar beets and potatoes, was strongly indicated.

FIG. 3.—Oats on plat K–IV–6. This was the highest yielding oat plat in the rotation experiments in 1913. The oats were grown on land which produced potatoes in 1912, and the yield was 126.8 bushels per acre.

PASTURING CORN AND ALFALFA WITH HOGS.

In connection with the rotation work, experiments in pasturing alfalfa and hogging corn have been carried on. This work is included in one of the 6-year rotations, which is as follows: Alfalfa for three years, followed by corn, flax, and beets. According to the plans the third-year alfalfa plat is to be pastured and the corn hogged instead of being harvested in the usual way. Since the rotations were not started until 1912, no third-year alfalfa was available in 1913, and the second-year alfalfa was pastured.

Pasturing alfalfa.—On the alfalfa plat in 1913 only the third crop was pastured, the first and second crops being cut for hay. In pas-

turing the alfalfa, the plat was divided into two equal parts and the hogs were pastured alternate weeks on each part. As soon as the hogs were removed from one part of the pasture that part was irrigated. By having the pasture thus divided, a good growth of alfalfa was secured and overgrazing was prevented. Figure 4 shows the hogs on the alfalfa pasture on September 10, or 34 days after the test was started, and the growth indicates that the alfalfa was not overgrazed.

On August 7 six spring-farrowed pigs, averaging 48.66 pounds in weight, were placed on the alfalfa. It soon became apparent that this number would not keep the alfalfa pastured down, so on August 17 six more spring pigs, averaging 67.16 pounds in weight, were added. The alfalfa pasture was supplemented by feeding 2 pounds of corn

FIG. 4.—Hogs on alfalfa pasture in rotation 67. It is estimated that these hogs paid $22.30 per ton for the alfalfa consumed.

per day for each hundred pounds of live weight of hogs. The hogs were taken off the pasture on September 17. During the pasture period the total gain made on the quarter-acre plat was 211 pounds, or at the rate of 844 pounds per acre. During the period, 9.9 bushels of corn were fed in addition to the alfalfa pasture. Valuing this corn at 90 cents per bushel and deducting this from the value of the gains made at 8 cents per pound, the net return from the quarter-acre of alfalfa from August 7 to September 17 was $7.97, or an equivalent of $31.88 per acre. The average yield from the third crop on nine comparable plats of alfalfa in the same field was 1.43 tons per acre. Assuming that the pastured plat produced the average yield, the value of the alfalfa when pastured by hogs was $22.30 per ton.

While this test was rather incomplete, because the hogs were on the alfalfa pasture but a short time, nevertheless the results indi-

cate that this means of utilizing the alfalfa crop would be more profitable than to harvest and sell the hay.

Hogging corn.—On September 26 four of the hogs used in the alfalfa pasturing test were placed on the quarter-acre plat of corn, their average weight then being 84 pounds. The total gain made during the period of 23 days that the hogs were on the corn was 192 pounds. The average daily gain per hog was 2.08 pounds. The value of the gains made at 8 cents per pound was $15.36 per plat, or $61.44 per acre. It was estimated that the corn plat produced at the rate of 60 bushels per acre. At this rate the value of the gains made by the hogs was equal to $1.02 per bushel for the corn consumed.

EXPERIMENTS WITH ALFALFA.

Time and method of planting.—An experiment in time and method of planting alfalfa was started in field A–IV in 1911. This experiment included early and late planting without a nurse crop, early planting with wheat as a nurse crop, and planting late in 18-inch rows to be cultivated. The rate of seeding of alfalfa was 12 pounds per acre except on the plats where the seed was planted in 18-inch rows, in which case the rate was 6 pounds. Wheat in the nurse-crop plats was planted at the rate of 1 bushel per acre. All plats were one-quarter acre in size.

The yields on these plats in 1911, 1912, and 1913 are given in Table IV.

TABLE IV.—*Yields obtained in the alfalfa-planting experiment on field A–IV at the Huntley Experiment Farm in 1911, 1912, and 1913.*

Date and method of planting.	Number of plats.	Average yield per acre (tons).				
		1911	1912	1911 and 1912	1913	Total 3 years.
May 5, 1911, early	3	2.43	5.64	8.07	5.23	13.30
June 5, 1911, late	3	2.00	5.35	7.35	5.45	12.80
June 5, 1911, in 18-inch rows	3	1.75	4.98	6.73	5.11	11.84
May 5, 1911, with wheat as a nurse crop, cut for hay in 1911	2	2.34	5.40	[1] 5.40	5.56	[1] 10.96
May 5, 1911, with wheat as a nurse crop, cut for grain in 1911	2	[2] 46.7	4.93	[3] 4.93	5.68	[3] 10.61

[1] Plus 2.34 tons of wheat hay. [2] Bushels of grain. [3] Plus 46.7 bushels of wheat.

From Table IV it will be noted that the total yield of the early planting for three years was somewhat higher than that of the late planting and of planting in 18-inch rows. The greatest differences in yields occurred in the first and second years. The differences in yield in 1913 were not great enough to be significant except in the case of the 18-inch-row planting, where the yield was slightly less than on any of the other plats. In comparing the yields on the nurse-crop plats,

consideration must be given to the grain and the grain hay produced the first year.

Table V shows the relative values of the crops produced on the different plats during the three years, the values being based on the yields obtained and the cost of production by the different methods. Alfalfa and wheat hay are valued at $6 a ton and wheat at 65 cents a bushel.

TABLE V.—*Gross and net values and cost of production of crops in the alfalfa-planting experiment on field A–IV at the Huntley Experiment Farm in 1911, 1912, and 1913.*

Value and cost.	Method or time of planting.				
	Nurse crop cut for—		Late planting (3 plats).	Early planting (3 plats).	18-inch rows (3 (plats).
	Grain (2 plats).	Hay (2 plats).			
Gross value	$94.01	$79.80	$77.80	$79.80	$71.04
Cost of production	37.86	34.12	33.78	36.06	31.46
Net value	56.15	45.68	44.02	43.74	39.58

The experiment was repeated in 1912 in field A–III. The yields obtained in this field in 1912 and 1913 are given in Table VI.

TABLE VI.—*Yields obtained in the alfalfa-planting experiment on field A–III at the Huntley Experiment Farm in 1912 and 1913.*

Date and method of planting.	Number of plats.	Average yield per acre (tons).		
		1912	1913	Total, 2 years.
May 11, 1912, early	3	2.16	4.79	6.95
June 14, 1912, late	3	.53	4.71	5.24
June 14, 1912, in 18-inch rows	3	.24	3.79	4.03
May 11, 1912, with wheat as a nurse crop, cut for grain	4	[1] 44.20	4.25	[2] 4.25

[1] Bushels of grain.

[2] Plus 44.2 bushels of wheat.

Table VI shows that the results favor early planting when the two years' results are considered, but that there was very little difference in the yields during the second year. The 18-inch-row planting gave the lowest yields during both the first and second years. The yield from the nurse-crop plats was very little lower in the second year than that from the plats planted without a nurse crop.

The value of the crops produced during the two years, together with the value of the crops produced during the first two years on field A–IV, and the average of the two, are given in Table VII.

TABLE VII.—*Gross and net values and cost of production of crops in two alfalfa-planting experiments at the Huntley Experiment Farm in 1911, 1912, and 1913.*

Value and cost.	Nurse crop cut for—		Early planting (3 plats).	Late planting (3 plats).	18-inch rows (3 plats).
	Grain (2 plats).	Hay (2 plats).			
Field A–III (1912–1913):					
Gross value	$54.23	.....	$41.70	$31.44	$24.18
Cost of production	22.96	.....	19.77	16.83	14.36
Net value	31.27	.....	21.93	14.61	9.82
Field A–IV (1911–1912):					
Gross value	59.93	$46.44	48.42	44.10	40.38
Cost of production	28.34	24.66	26.79	24.39	22.25
Net value	31.59	21.78	21.63	19.71	18.13
Average net value, both fields	31.43	21.78	21.78	17.17	13.97

Table VII shows that the practice of planting alfalfa with a nurse crop and harvesting the nurse crop for grain has been by far the most profitable when the first two years' results are considered and that early planting gave higher returns than late planting. The lowest returns were obtained from the 18-inch-row plantings.

Harvesting alfalfa.—A test to determine the effect of cutting alfalfa at different stages of growth was conducted in 1913 on 11 quarter-acre plats in field A–I. The alfalfa on these plats was planted in 1912. The plan of the experiment was as follows: The first cutting of each crop was made at the first appearance of the basal shoots, and later cuttings on the other plats were made at 5-day intervals following the first cutting. Table VIII shows the yields obtained in this experiment.

TABLE VIII.— *Yields of alfalfa obtained in the time-of-cutting experiment at the Huntley Experiment Farm in 1913.*

[Tons per acre.]

Number of plats.	First crop.		Second crop.		Third crop.		Fourth crop.		Total for year.	
	Date cut.	Yield.	Date cut.	Yield.	Date cut.	Yield.	Date cut.	Yield.	Number of crops.	Yield.
2	June 5	1.86	July 17	1.36	Aug. 22	1.44	Oct. 1	0.81	4	5.47
2	June 10	2.33	July 27	1.46	Aug. 27	1.70	...do....	.33	4	5.82
2	June 14	1.92	...do....	1.71	Sept. 1	1.39	.....	.....	3	5.02
2	June 20	1.58	Aug. 2	1.73	Sept. 6	1.43	.....	.....	3	4.74
3	June 25	2.51	Aug. 7	2.03	Sept. 12	1.77	.....	.....	3	6.31

The results indicate that delaying the harvest of the first crop did not have the effect of reducing the yield of the second crop. There was, on the contrary, a consistent increase in the yield of the second crop as the growing period of the first crop increased. The yields obtained in 1913 indicate that three cuttings a year will be more profitable than four cuttings. This experiment will be repeated in 1914.

TEST OF PASTURE GRASSES.

A test of pasture-grass mixtures and separate grasses was started in the spring of 1913 on a series of plats in field A–II. The mixtures were planted on quarter-acre plats. The mixtures and the rate of seeding of each grass and legume in the mixture were as follows:

Mixture A contained timothy, 4 pounds; meadow fescue, 2 pounds; redtop, 4 pounds; tall fescue, 2 pounds; Kentucky bluegrass, 4 pounds; Italian rye-grass, 2 pounds; orchard grass, 6 pounds; western wheat-grass, 6 pounds; awnless brome-grass (*Bromus inermis*), 2 pounds; and perennial rye-grass, 2 pounds.

FIG. 5.—Plat of orchard grass 60 days after planting in 1913, showing the thick, uniform stand and vigorous growth. The results obtained at the Huntley Experiment Farm in 1913 indicate that pastures can be made very successful on this project.

Mixture B was the same as A except that 2 pounds each of white clover and alsike clover per acre were added, and mixture C was the same as B except that 2 pounds of alfalfa per acre were seeded with the grasses and clovers.

Mixtures A and B were planted on very heavy soil and only a fair stand was secured. A very good stand was secured with mixture C. The first year's results indicate that pastures can be successfully established on the Huntley project. It is expected that tests will be made in 1914 to determine the carrying capacity of the pasture mixtures planted in 1913.

In order to determine which of the grasses included in the mixtures mentioned were best adapted to the conditions on the project, each of these grasses was planted separately in twentieth-acre plats. All of the grasses made excellent growth during the first year, except timothy, Kentucky bluegrass, western wheat-grass, and redtop. A plat of orchard grass is shown in figure 5.

FIELD CORN.

A test of corn varieties, to determine those maturing earliest and best suited to conditions on the project, was conducted in 1913 in cooperation with the Office of Corn Investigations. Seven varieties were used in the test. These varieties yielded as follows: Minnesota No. 13, 27.42 bushels per acre; Selection No. 133, 26.16 bushels; Ardmore Dent, 25.63 bushels; Northwestern Dent, 25.13 bushels; Brown County Yellow, 24.43 bushels; Minnesota No. 23, 23.66 bushels; and Disco Flint, 18.10 bushels.

The season was free from frost late enough to allow all the varieties to mature well. The earliest maturing varieties were Northwestern Dent and Disco Flint, which matured about 10 days earlier than any of the other varieties.

IRRIGATION TEST WITH FLAX.

At the request of the Montana experiment station a test to determine the proper time of applying water to flax, and especially the effect of late irrigation after the flax is through blooming, was conducted in 1913 on 8 tenth-acre plats in field C–VI. The soil in this field is very heavy and a rather poor stand of the crop was secured. The yields obtained were in favor of two irrigations, although when the second irrigation was applied, after the flax was well through blooming, there was a tendency for the plants to continue to bloom, with the result that there was a small proportion of bloom and some unmatured seed when the larger part of the crop was ready to harvest. The average yield of four plats that received but one irrigation, which was applied when the flax began to bloom, was 5.15 bushels, while the average yield of four plats that received two irrigations was 6.25 bushels.

FERTILIZER TEST.

At the request of the Montana experiment station a test to determine the value of acid phosphate as a fertilizer was conducted in field B–VII on 12 tenth-acre plats. The crops used in this test were wheat, oats, and barley. Fertilizer was applied to each crop at the rate of 300, 500, and 700 pounds per acre. This fertilizer was in the form of acid phosphate, of which each 100 pounds contained 3.71 pounds of phosphorus. As a check on the effect of the fertilizer one plat of each crop was grown without fertilizer. The average yields of the crops were as follows: Wheat, 46.7 bushels; barley, 59.4 bushels; and oats, 101.05 bushels per acre. No significant differences occurred in the yields that could be attributed to the fertilizer, and there was no apparent difference in the color or appearance of the growing crop.

ORCHARD TREES AND SMALL FRUITS.

A 5-acre tract in field A is devoted to tests with fruit trees and small fruits. In 1911 about 100 varieties of apples, cherries, and plums, together with 26 varieties of small fruits, were planted. In the winter of 1911–12 about 50 per cent of the trees were winter-killed, and it was necessary to replant them in the spring of 1912. Only about 15 per cent of the trees were lost during the winter of 1912–13. These trees made good growth during the season of 1913. It seems apparent from the results so far obtained that in an ordinary year many young trees are liable to be injured by the severe winter weather and that only apples and plums and perhaps some varieties of sour cherries can be expected to prove hardy. It will probably be necessary to replant in many cases before an orchard can be successfully established.

RECLAMATION OF THE WORDEN TRACT.

Experiments were started in 1910 on 12 acres of a 40-acre tract near the Worden town site to determine means of reclaiming the heavy alkaline soils of the project and of bringing the land into production. The soil on this tract, which is representative of about one-fourth of the lands on the Huntley project, is a very heavy, impervious clay that contains excessive amounts of alkali salts.

The physical character of the soil is such as to prevent natural leaching and there has been a consequent accumulation of salts in the surface layer of the soil. This surface soil is underlain by a stratum of sand and gravel at a depth of 5 to 8 feet. The problem involved in the reclamation of this land appears to be the opening up of the surface soil so as to bring about artificial leaching.

Three methods of reclaiming this land have been tried. The first was the plowing under of a crop of rye as green manure in 1911 and again in 1912 and keeping the ground thoroughly cultivated each season after plowing the crop under. The second method included plowing under rye as green manure in 1911, followed in the latter part of 1911 and all of 1912 by irrigation and cultivation by means of the bordered-check system. Irrigation water was applied on these plats at about 10-day intervals and each time was followed as soon as possible by cultivation to keep the soil opened up and to start a downward movement of the water through the soil to the underlying gravel. The third method was the same as the second except that manure was applied to the land at the rate of 20 loads per acre in 1911 and again in 1912.

All the land was cropped in 1913. Land on which two crops of rye as green manure had been plowed under produced winter wheat

at the rate of 29.4 bushels per acre on 10 quarter-acre plats and at the rate of 28.70 bushels per acre on a 6¾-acre field. Sugar beets on this land yielded at the rate of 10.97 tons per acre. Alfalfa was planted on one plat that had received this treatment and a fair stand was secured, although, of course, the success of this crop will not be known until another season. Alfalfa and oats were planted on the land that had received treatment according to the second method. Oats yielded at the rate of 51.56 bushels per acre and a good stand of alfalfa was secured. On the land that was treated according to the third method, spring wheat yielded 36 bushels per acre; sugar beets yielded 7.86 tons; and oats yielded 68.87 bushels.

Determinations of the total salt content of the soil indicate that the practice of plowing under rye as a green-manure crop has been more effective than either of the other methods in reducing the salt content. This method has also been found to be much less expensive.

Approved:

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